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Sarmistha Pal

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Elderly Health, Wealth and Co-residence with Adult Children in Rural India

Sarmistha Pal*

Department of Economics and Finance,

Brunel University,

Uxbridge UB8 3PH, UK

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Abstract: Little is known about the living conditions of a growing number of elderly in India who predominantly coreside with their children. Mutual sharing of responsibilities is important in coresidency arrangements involving exchange of financial and other services between the elderly and their coresident children. The paper thus focuses on health and wealth effects of elderly on coresidency arrangements. In an attempt to redress the resultant endogeneity bias, we estimate a correlated recursive system of equations. There is evidence that the probability of coresidence is lower for those disadvantaged older elderly who lack health, wealth or both, thus necessitating social protection.

JEL Classification: H55, I31, J14

Keywords: Co-residence with children, Intergenerational transfers, Elderly health and wealth effects, Simultaneity bias, Correlated recursive model.

* Address for correspondence: Department of Economics and Finance, Brunel University, Uxbridge UB8 3PH, UK.. E-mail: sarmistha.pal@brunel.ac.uk. Fax: 01895 269770. Initial work for this paper was done when I was a member of staff at Cardiff University. I would like to thank Cardiff University and Cardiff Business School for providing the grant to purchase the data and Sumon Bhaumik, Ralitza Dimova, Gerald Makepeace, Robert Palacios, Stan Panis, Irudaya Rajan, Alessandro Tarozzi for helpful comments on an earlier version of this paper. I am however solely responsible for any errors.

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1. INTRODUCTION

Population is ageing in most countries today though the implications of ageing are more serious for developing countries like India where there are problems of earning from assets in old age, where credit and insurance markets are poorly developed and where there is no tradition of extra familial welfare institutions.[1] Traditionally elderly persons in India tend to predominantly coreside with children, who bear the burden of caring for the elderly parents though little is known about the living conditions of a growing number of elderly in India. In this context the present paper examines the nature of intergenerational transfers among coresident elderly in rural India.

Existing literature is diverse and yet limited, especially for low-income countries. These studies tend to highlight the importance of financial resources (e.g., financial support from adult children[2] or elderly person's accumulated wealth) as old age security in low-income regions, generally characterised by poverty and lack of personal wealth as well as absence of any extra-familial welfare institutions. First, population and development theorists tend to highlight the fertility motive for old age security whereby children are the main source of old age security in low-income countries. This literature focuses on (a) role of parental wealth (Raut, 1996) and also how wealthy parents can induce greater assistance from children (Hoddinott, 1992). (b) Uncertainty of expected transfer from children on demand for children (Jellal and Wolff, 2002).

[1] Majority of the older people in India work outside the formal sector and lack the capacity to save. Only 1 in 10 Indian workers participates in some pension schemes (World Bank, 1994).

[2] Nugent and Gillaspy (1983) argued that social security may act as a substitute for children.

A second strand of the literature argues that intergenerational transfers are dominated by the financial support from adult children to elderly parents (e.g., see Kochar, 2000). Justifications for the financial transfers may include altruism of family members, returns to parental investment in education of young children (Lillard and Willis, 1997), payments for services (e.g., child care) by family members. Finally, a third strand of the literature directly examines the determinants of coresidency with children in some low-income countries and among other things highlight the role of parental income or housing prices (e.g., see Da Vanzo and Chan, 1994) on coresidency with children while some others (e.g., see Cameron, 2000) report only small effects of these economic variables on elderly coresidency arrangements.

These existing studies tend to highlight the role of parental wealth and also the financial transfers from adult children to elderly parents. In doing so, the literature, not only overlooks the role of various *non-financial* services provided adult by children (e.g., health[3] and other personal care, especially for the frail and sick ones) in old age[4], but also the *reverse flow of services* from elderly parents to their adult children (e.g., participation various household chores, including looking after young grand children) well into their old age.[5] Accordingly, the present paper examines the significance of various financial and other non-financial contributions made by the elderly as well as their adult children on coresidency. In doing so, we integrate various strands of the literature and argue that mutual sharing of responsibilities is particularly important in coresidency arrangements (though overlooked not only in the transfer literature but also

[3] Kochar (1999) argues that medical expenditures on the elderly in rural Pakistan declines with elderly person's declining economic contributions which is closely related to a sharp decline in wages rates with age.

[4] An exception is Hoddinott (1992), who considered both financial and other types of assistance, provided by children and argued that elderly parents in western Kenya can induce greater assistance with household tasks and also monetary transfers if they have more inheritable assets.

[5] This especially important in view of the Indian philosophy of 'Karma' where death is really the only retirement for most elderly. Literally, 'karma' is a Sanskrit word meaning work or action. Karma is not only a philosophy but also a way of life according to an ethical code of conduct through which we can change our lives.

in the direct determination of coresidency arrangements) between elderly parents and adult children. Decision of coresidence is a joint decision and depends on the comparison of each agent's (elderly parent or adult children) utility levels when living alone and when coresiding. The empirical analysis is based on the 52nd round National Sample Survey (NSS) data from the rural sectors of the Indian states. This is a special round of the NSS that collects additional information on the elderly members of sample households living in different states of India. We choose to focus on the rural households because of the greater poverty and vulnerability of the elderly people residing in the rural sector. Unlike their urban counterparts, many rural elderly lack financial assets and/or property. A majority of rural Indians tend to work in the informal sector where there is no provision of regular income after retirement.

The paper is novel in a number of ways. We depart from the existing literature to argue that an elderly person's coresidence with children is an important aspect of intergenerational transfers[6], involving transfers not only in terms of housing consumption, but also other financial and non-financial exchanges between elderly parents and adult children in a mutually beneficial way. On the one hand, children may provide financial and other personal assistance to their elderly parents. On the other hand, elderly parents too continue to contribute to the family both financially and otherwise well into their old age. Thus we are able to assess the relative significance of each contribution in our analysis. Secondly, subject to the data limitations (see discussion in section 3), our analysis distinguishes between (a) financial and non-financial assistance from children and (b) financial and non-financial assistance from elderly parents. While we directly observe if elderly parents are financially dependent on children, we do not observe elderly parents' personal/medical dependence on coresident children; we, however, use an elderly person's intensity of actual health problems to be an indicator of their dependence on

coresident children for personal/medical care. So far as the contributions of an elderly person are concerned, we use their ownership of property and/or financial assets (also called wealth) as a good index of their financial contribution. Non-financial contribution on the other hand is measured by a composite index of elderly person's participation in daily household chores, social and religious matters. Finally, modelling coresidence in terms of financial and non-financial contributions of children and elderly members of the household is far from being straightforward. For one thing, there are serious self-selection issues to be sorted out – otherwise estimates of single coresidency equation in terms of financial and non-financial contributions of adult children and elderly parents will be biased. This is because an elderly person who owns wealth and/or contributes otherwise to the family is not a random subset of all elderly members coresiding with children; similarly, coresident adult children who may assist elderly parents financially and otherwise are not a random subset of all adult children. Thus the correlation between any pair of unobserved error terms in these relevant decisions (e.g., that pertaining to elderly health, wealth or participation in household chores) is likely to be non-zero. Traditional approach to solve this kind of endogeneity problem would be to identify the relevant instruments for these variables (e.g., elderly person's financial dependence on children or his/her ownership of wealth) and then estimate the coresidence equation using instrumental variable method. It is however not so simple to find appropriate instruments for these decisions, especially in single cross-section data-set. Our approach to solve this problem has been to use a correlated recursive system of equations comprising of elderly person's financial dependence on children, intensity of elderly health problems (as a measure of non-financial dependence on children), elderly person's ownership of wealth as well as their participation in various household chores (as measures of elderly person's contribution to the family) along with the coresidence equation. In other words, we allow for the

[6] Generally home sharing arrangement is considered to be an important part of family redistributive efforts.

source of endogeneity (i.e., cross-correlations between these decisions) in the relevant equations and correct for the possible endogeneity, which otherwise could seriously bias the estimates. [7]

Our results highlight the extent of the bias if we do not address the endogeneity issues. These corrected estimates also suggest that financial dependence on children is not important for coresidence while an elderly person's wealth and participation in daily household chores are highly significant: for a given health status, a wealthy elderly person is less likely to coreside while for a given wealth, an elderly person is more likely to coreside if s/he is able to participate in household chores. These results raise concern for those elderly who do not have health, wealth or both or disadvantaged in other ways (e.g., older elderly or widowed elderly female0. Unless policies and social protection schemes specifically address issues of the old age poverty,[8] targets for poverty reduction will not be achieved.

The paper is developed as follows. Section 2 describes the data and section 3 explains the methodology. Section 4 analyses the results and the final section concludes.

2. DATA

We use the fifty-second round NSS data from the rural sector of different states and union territories in India collected in 1995-96. This particular round of NSS data provides additional information on the elderly members of the sample households, aged sixty years and above. In particular, we observe living arrangements, state of economic dependence, ownership/management of financial assets and/or properties, actual health problems of the elderly as well as their participation in daily household chores and social/religious matters.

[7] These correlated estimates would also be better than the fixed effects single equation logit estimates of coresidency in terms of elderly wealth, participation in household work, financial dependence on children and intensity of health problems, among other possible covariates. Although the fixed effects estimates take account of family fixed effects (something like the unobserved heterogeneity terms in our model), it does not allow for non-zero correlations between each pair of unobserved heterogeneity terms.

[8] There are no official data on the income of the elderly in India.

2.1. Nature of living arrangements in rural India

The data-set includes elderly members aged sixty or above of different marital status living in the rural sector of different states in India. We have excluded the never married elderly members from our analysis as none of them had any children in our sample. The sample of elderly members consists of household head, his/her spouse, parents or parents-in-law and other relations or non-relations of the head of the household. We however choose to consider the head and his/her spouse aged sixty or above as we can identify the characteristics of their children (that feature prominently in our analysis of old age security), which is not possible for other elderly members.[9] This gives rise to a sample size of 13810 elderly members.

Information on co-residence with children is obtained from the pattern of living arrangements. We can identify if someone is living with spouse and children or with children only (without the spouse). The latter is closely related to the marital status of the elderly persons: while a majority of currently married elderly members with children co-reside with spouse and children, a majority of widowed/separated elderly members with children co-reside with children only. However, a majority of currently married elderly members *without children* co-reside with spouse only. Other types of living arrangements are also observed, e.g., whether someone is living on his/her own, or in an old home or living with other relations or even non-relations, though the proportions of cases are not that significant in our sample. Selected characteristics of all elderly members with different types of living arrangements are summarised in Table 1A.[10] A clearer pattern is found when we distinguish between elderly persons *with/without* children. As high as 98% of both married and widowed elderly members *with children* tend to coreside with

[9] Compared to the non-household head elderly members (34% of the full sample comprising of parents/parents-in-law and other types of relatives), this may be a sample of better-off elderly. We needed to focus on this group of elderly heads and their spouses as we needed information on *all* their children. We however intend to study the case of non-household head elderly in a separate paper.

[10] All figures are adjusted by sample weights.

children (with or without the spouse).[11] In contrast, considering the elderly members *without children*, about 95% of currently married men and women live with spouse only; 68% widowed women and 47% widowed men live on their own or in an old home while others tend to live with other relations or non-relations. Thus in the absence of any extra familial traditions of old age security, elderly men and women *without children* are more vulnerable than those with children and co-residing with children (with or without spouse) though in this paper we focus only on elderly men and women with children.

Table 1B compares some selected characteristics of elderly members with children in three different modes of living arrangements: (a) those living with children (with or without spouse), (b) those living with spouse only and (c) those living alone, in old home or with other non-relations.[12] Clearly, a higher proportion of elderly persons living with children tend to own properties and financial assets while a lower proportion of them have made provision of regular income. Secondly, a lower proportion of elderly members living with children suffer from chronic illness, physical disability or immobility. Thirdly, proportion of elderly members participating in social and religious matters is high and comparable across these different living arrangements though the proportion of them participating in daily household chores is slightly lower among those living with children.

Finally, we compare the average per capita household expenditure (APCE) for elderly persons in different living arrangements and also examine the sensitivity of (a) equivalence scale adjusted APCE to different choice of weights given to adult (>=15 years) male, adult female and children (0-14 years old) respectively: (1,1,0.6), (1,0.8,0.6), (1,0.7,0.5). (b) We also examine the sensitivity of APCE for various choice of weights for the size economies of consumption, namely, 0.8, 0.6, 0.4, & 0.2 to compare adjusted APCE among different living arrangements.[13]

[11] We note that more than 90% of these elderly members have at least one son coresiding with them. So it is highly likely that most of them tend to coreside with sons.
[12] Only a third of the elderly living on their own has children or relatives living in the same village/town.
[13] Note that a lower weight is associated with greater size economies in consumption.

Both unadjusted and adjusted APCE are shown in Table 1C. While the unadjusted APCE does not seem to vary much between alternative living arrangements, equivalence scale adjusted APCE figures are significantly higher for elderly persons living with children irrespective of the choice of weights. The same holds for different choices of size economies in consumption, even when there are smaller economies of scale. These figures seems to suggest that coresident elderly persons make significant contribution to the family well into their old age, which is generally overlooked in the literature (see Pal and Palacios, 2006 for an inter-state comparison).

3. AN ANALYSIS OF CORESIDENCE WITH CHILDREN

In view of our preliminary findings in section 2**,** we argue that elderly persons' co-residence with children (and thus children's co-residence with elderly parents) is likely to be a mutually advantageous arrangement in rural India. This could be rationalised in terms of a cooperative bargaining framework. Suppose the utility functions of the child (C) and the parent (P) are respectively characterised as follows:

$$U^C = U^C(X^C, A^P, H^P, L^P, L^C)$$
$$U^P = U^P(X^P, A^P, L^P, H^P, TR^C)$$

where X^i and L^i are respectively the vector of private goods and leisure enjoyed by i, i = C, P respectively for the child (C) and the parent (P). Elderly parents receive financial transfer TR^C from the child while both the child and the parent enjoy the parental assets A^P (joint consumption of parental house[14] is an essential part of coresidency arrangement) to enhance individual utilities of the child and the parent). In addition, a child's utility is assumed to increase with parental

[14] This will especially be the case if the assets include the parents' residential home.

health H^P [15] while an elderly parent's utility increases with financial transfer TR^C from children. Also note that elderly leisure L^P (net of participation in various household chores and labour market, if any) is an argument in child's utility function[16] and there could arise some conflict of interest in this respect: for example, greater elderly leisure L^P will enhance elderly utility, but is expected to lower children's utility as this would mean lower parental involvement in child-related services (e.g., care of the grand children or help with daily household chores).

Elderly parents and the child may either live independently or they may collude to form a joint household. We suppose that in isolation, the parent and the child simultaneously make their own decisions (i.e., each will maximise individual utility subject to own budget constraint), taking the decision of the other to be given (corresponding to a Cournot-Nash equilibrium, for example). The latter would yield two reaction functions, which in turn will determine the optimal levels of indirect utility (μ^C, μ^P) that each will enjoy in isolation. In case they decide to coreside, they will jointly maximise the product of each individual gain (relative to their respective threat points μ^C, μ^P in isolation) subject to the joint budget constraint (corresponding to a Nash bargaining solution, for example). Consequently, the coresidency decision will be determined in terms of individual contributions of both the adult children (financial transfer TR^C as well as personal care related to an elderly parent's health status H^P) and elderly parents (own assets A^P and leisure L^P that in turn determines the value of their labour services at home and/or in the market place[17]) choosing to coreside.

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[15] There could be an aspect of altruism; but more realistically, an elderly person's health problems could be viewed as a cause for concern for the coresident child who is responsible for looking after the elderly when sick and frail.

[16] Note that child's leisure does not enter parental utility function.

[17] Note that in this paper we do not consider the value of an elderly person's labour market participation because that raise further endogeneity issues and has been discussed elsewhere (e.g., see Cameron and Clark, 2001).

Thus in this paper we distinguish between financial and other non-financial contributions[18] of both elderly parents and their adult children and also study the impact of these two-way contributions on coresidency arrangements. Although we attempt to highlight the two-way flow of services between elderly parents and co-resident adult children, we are constrained by the availability of some relevant information. For example, there is information whether an elderly member is financially dependent on their own children though we cannot identify whether elderly parents receive financial support from *co-resident* or *non-coresident* children. We cannot also identify if assistance is provided by a *son/daughter - married/unmarried*. The data-set also does not provide any further information regarding the types of non-financial assistance children may provide to their elderly parents. Thus, motives are not always directly observable and hence one needs to identify *indirectly* the a priori circumstances that may influence the intensity of the motive for co-residence.

We consider a static one period framework and posit, without much loss of generality, that current coresidence with children would among others be determined by the financial and other contributions of the elderly person and his/her adult children. This allows us to abstract from the dynamics of family formation as well as life-cycle consumption and labour market decisions. Financial contribution of adult children is directly observed in our data in terms of whether the elderly person is financially dependent on children (FINDEP). While we do not directly observe medical and other personal care offered by coresident children, we argue that the intensity of health problems of the elderly would be a good measure of the care offered by coresident children. We derive a composite health indicator (HLTHPR) from three indicators of actual health problems: (i) chronic illness (e.g., heart problem, blood pressure, diabetes etc.); (ii) physical disability (e.g., hearing, vision, speech etc.) and (iii) physical immobility (confined to

[18] Previous literature (mostly for developed countries) tends to identify resources of the elderly including income (Englehardt et al. 2002), wealth, health (Mutchler and Burr, 1991) and kinship status to be important factors affecting living arrangement choices. Association between change in functional ability, or marital status on the one hand and living arrangements on the other is also documented in the literature (e.g., Worobey and Angel, 1990; Spitze et al, 1992).

bed or home). The resultant variable HLTHPR is a categorical one: it takes a value 1 if the elderly person suffers from one of these problems; 2 if the elderly person suffers from two of these problems and 3 if the elderly person suffers from all three of these health problems and zero otherwise.[19] In other words, the health status variable is a measure of intensity of health problems faced by the elderly person which in turn would instrument the intensity of personal care offered by coresident children.

So far as the contribution of the elderly person is concerned, again we distinguish between financial and other services provided by them. We use a composite wealth indicator (PROPFA) to measure the financial contribution of an elderly. The variable PROPFA takes a value 1 if the elderly person owns any property[20] and/or financial assets and zero otherwise. So far as the non-financial contribution of the elderly is concerned, we use a composite measure whether the elderly person participates in daily household chores, religious and social matters (HWORK).

The complete model would also control for a number individual/household specific factors as discussed in the following section.

3.1. Modelling Coresidency

The primary variable of our interest is the coresidence with children.

CORESIDE = 1 if an elderly lives with children (with/without spouse)

= 0 otherwise

Thus for an elderly person i from a household j, the decision to coreside is given by: $CORESIDE_{ij} = \beta X_c + \eta_{cj} + u_{cij}$ where X_c is a set of observable individual/household

[19] It is also worth emphasizing here that the indicators of health used in our analysis are measures of actual health problems, rather than the instrumental activities of daily living. Hence, we do not need to treat health as a latent immeasurable variable.

[20] While we do not specifically know if the family house is owned by an elderly person, elderly person's ownership of property is taken to be a measure of his/her ownership of family house.

characteristics explaining coresidence. η_c (family-specific) and u_c (individual-specific) capture residual variation (see further discussion below).

Specification of X_C : Co-residence with children depends not only on age (whether the elderly person is aged 75 or more, i.e., AGE75)[21], gender (MALE), schooling (primary or higher) and marital status (i.e., whether has a spouse of not, WIDSEP) of the elderly person, but also on measures of financial dependence on children (FINDEP), intensity of health problems (HLTHPR), wealth (PROPFA), as well as his/her participation in daily household chores, social and religious matters (HWORK). We also control for the regional variation in the pattern of elderly living arrangements by including a number of regional dummies (EAST, NORTH1, NORTH2, SOUTH).[22] These regional dummies would account for the inter-state variation in socio-economic set-up and/or public assistance offered to the elderly (e.g., see Pal and Palacios, 2006).

In addition to the observable characteristics explained above, it is likely that household-level unobserved heterogeneity may be significant in explaining coresidence with children in our sample. For example, we do not observe the life cycle income or consumption profile of the elderly person or wealth of other members of the household, though the latter could affect the living arrangements significantly. In our analysis this household/family specific unobserved heterogeneity is accounted for by η_c where $\eta_c \sim N\left(0, \sigma_c^2\right)$ is assumed to be uncorrelated with other covariates.[23] All other individual-level residual variation is captured by u_C: $u_C \sim IIDN(0,1)$.

[21] We identify older elderly aged 75 or more from all elderly (aged 60 and above) as Pal and Palacios (2006) suggest that compared to all elderly (60+) labour market participation rate declines sharply among older elderly (75+).
[22] For definitions of these variables, see note to Table 3.

3.2. Endogeneity issues

Addressing endogeneity is a difficult problem in our analysis where an elderly person's coresidence with their children depends, among others, on financial support from adult children, elderly person's health, wealth as well as their participation in daily household chores. Even if we could assume marital status, education and past employment of the elderly person to be given within a static one-period framework, we need to address the bias generated by the correlations between elderly person's coresidence with children on the one hand, and their current wealth, health, participation in various household chores and financial dependence on adult children on the other. Ignoring this simultaneity is likely to bias our estimates. To redress this problem, we determine the coresidency decision jointly with wealth, health, participation in household chores and financial dependence on children as a recursive correlated system of equations. This is explained below.

Firstly, a possible source of simultaneity arises from the inclusion of financial dependence on children (FINDEP). This is because financial support from adult children to elderly parents is a reflection of the human capital investment by the same parents when children were young.[24] So the equation that we estimate here is as follows: $FINDEP_{ij} = \beta_D X_D + \eta_{Dj} + u_{Dij}$ where X_D refers to a vector of explanatory variables (see Table 3A), η_D captures family-specific unobserved heterogeneity and u_D captures any other residual variation: $\eta_D \sim N(0, \sigma_D^2)$ and is uncorrelated with all other covariates while $u_D = IIDN(0,1)$.

The second possible simultaneity arises with respect to the inclusion of current health problems (HLTHPR) into the coresidency equation. On the one hand, given the health problems,

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[23] This is a standard assumption in random effects panel data model of this type.

[24] Since the same elderly person takes both decisions, i.e., investing in young children and deciding whether to accept financial transfer from these children and also whether to coreside, there is likely to be a correlation between these decisions.

an elderly person may decide to coreside with children. On the other hand, there is some literature suggesting that choice of residential location may affect health (e.g., Borsch Supan et al., 1996). Given this possibility of simultaneity between co-residence and health problems, we estimate the following equation for i-th elderly living in j-th household: $HLTHPROB_{ij} = \beta_H X_H + \eta_{Hj} + u_{Hij}$ where X_H refers to a vector of household/individual specific explanatory variables (see Table 3A), η_H captures unobserved heterogeneity (family-specific) and u_H captures any other residual variation such that $\eta_H \sim N(0, \sigma_H^2)$ and is uncorrelated with all other covariates and $u_H = IIDN(0,1)$.

Elderly person's current wealth as measured by the ownership of financial assets and/or properties (PROPFA) could be a further source of simultaneity. This is because current wealth is a reflection of past economic activities as well as savings behaviour of the elderly over the life cycle with a view to provide for the old age, among other things. In other words, current wealth is an alternative form of old-age insurance and therefore is likely to have two-way effects between wealth and current living arrangements. In an attempt to address this problem, we estimate the following wealth equation for the i-th elderly living in j-th household: $PROPFA_{ij} = \beta_W x_W + \eta_{Wj} + u_{Wij}$ where X_W refers to a vector of explanatory variables affecting wealth, η_W captures family/household-level unobserved heterogeneity and u_F captures any other residual variation where $\eta_W \sim N(0, \sigma_W^2)$ and is uncorrelated with all other covariates and $u_W = IIDN(0,1)$. List of explanatory variables included in the wealth equation is summarised in Table 3A.

Finally, an elderly person's participation in daily household chores (HWORK) could also generate some simultaneity bias in the estimates of coresidency as there could

be a two-way causality between the two. In an attempt to redress this, we estimate the following participation equation: $HWORK_{ij} = \beta_P x_P + \eta_{Pj} + u_{Pij}$. As before X_P refers to a vector of explanatory variables affecting participation, η_P captures unobserved household-level heterogeneity and u_P any other residual variation: $\eta_P \sim N(0, \sigma_P^2)$ and is uncorrelated with all other covariates while $u_P = IIDN(0,1)$. List of explanatory variables included in the wealth equation is summarised in Table 3A.

Four of the relevant decision variables, namely, CORESIDE, PROPFA, HWORK and FINDEP are binary in nature while the health variable (HLTHPR) is a categorical variable assuming values 0, 1, 2, 3. Accordingly, we use a multinomial logit model to estimate the health equation while we use univariate probit models to estimate the other four equations determining the binary dependent variables.

In order to build up a coherent model (see Maddala, 1982 pp. 117-125), we develop a recursive system of equations such that the summed probability over all possible outcome combinations is equal to one. Thus we do not allow for any interdependence between/among financial dependence (FINDEP), health (HLTHPR), wealth (PROPFA), and participation (HWORK) equations. However in the completely correlated model decision to coreside with children (CORESIDE) could be correlated with the unobserved family specific error terms in the four auxiliary equations (e.g., financial dependence, health problems, wealth and participation equations; see specification 5 below).[25]

Identification of the system is not only ensured by the non-linear nature of the likelihood, but also by the recursive nature of the model. Thus, the coresidency equation is clearly identified by the inclusion of an elderly person's financial dependence on children, intensity of health

[25] There could also be some interaction between financial dependence on children and the wealth of the elderly; similarly, one cannot also rule out the possible interaction between intensity of health problems and participation in daily household chores. In order to address this issue, we also include two additional interactions terms in an alternative

problems, wealth and participation in various household chores. Besides, there is at least one identifying variable in each equation that arises by the very nature of the particular decision.[26] This is summarised in Table 3A (the Table also lists the definitions of variables). For example, an elderly person's financial dependence on children is likely to be contingent upon whether an elderly person has any educated children, though we cannot predict any direct relevance of the variable for the other decision variables. Significance of educated children in the financial dependence equation would also reflect whether an elderly person's financial dependence on children is a return to their human capital investment in young children. Ideally, use of various health inputs would be identifying variable in the health equation. In the absence of any better indicator, we take predicted value of average per capita monthly consumer expenditure (APCE)[27] as the proxy for use of various health inputs in the health equation. Now considering an elderly person's contribution, current wealth of the elderly is a reflection of his/her earnings over the lifetime and is likely to depend on whether s/he has once been economically active. Finally, presence of grand children aged five or below has been used as an identifying variable in the participation equation of the elderly. This is because looking after the young grand children is often considered to be a traditional role of coresident grand parents in India. One could however suggest that whether an elderly person has once been economically active or has invested in children's education is also likely to be endogenous to coresidency decisions. For the purpose of this paper, we shall however abstract from aspects of family formation and/or previous labour market decisions and treat these variables to be exogenously given within a static one-period framework.

Means and standard deviations of the included variables are summarised in Table 3B.

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specification. However there were problems of convergence in the complete model when we included these interaction terms.

[26] Note that we started with the same set of variables in all the equations and then arrived at the final specification by dropping the variables with the lowest levels of significance. This also allowed us to rationalise the inclusion of identifying variables in the most parsimonious specifications shown here.

3.3. Correlated Estimates

The main reason for the joint estimation is the simultaneity and the implicit self-selection: elderly persons who have accumulated wealth, suffer from some or other health problems, participate in daily household chores and elderly persons who choose to coreside with their children are not necessarily a random subset of all elderly persons in the sample. All these essentially mean that the pair-wise correlation between the family-specific unobserved heterogeneity terms in the coresidency equation on the one hand and that in any of the four auxiliary equations (e.g., wealth, health, financial dependence on children or participation in household chores equation) on the other could be non-zero: i.e., $Cov(\eta_i, \eta_j) \neq 0$, i,j = C, D, W, H, P, $i \neq j$. However conditional on all the heterogeneity terms, the equations are independent and the conditional joint likelihood can be obtained by simply multiplying the individual likelihoods.

The joint marginal likelihood function can be written as:

$$\int_{\eta_c}\int_{\eta_W}\int_{\eta_D}\int_{\eta_H}\int_{\eta_P}\left[\prod L^C(\eta_C)\prod L^W(\eta_W)\prod L^D(\eta_D)\prod L^H(\eta_H)\prod L^P(\eta_P)\right]$$

$$f(\eta_c,\eta_W,\eta_D,\eta_{H,}\eta_P)d\,\eta_c d\,\eta_W d\,\eta_D d\,\eta_H d\,\eta_P$$

where $f(\eta_C,\eta_W,\eta_D,\eta_H,\eta_P)$ is the joint distribution of the unobserved heterogeneity components. Here $f(\eta_C,\eta_W,\eta_D,\eta_H,\eta_P)$ is a five dimensional normal distribution characterised as follows:

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[27] Since average per capita monthly consumer expenditure depends on household structure and earnings, it too would suffer from simultaneity bias. Hence we use the value of average per capita consumer expenditure (APCE) predicted by various household composition variables as well as the characteristics of the head of the Household.

$$\begin{pmatrix} \eta_C \\ \eta_W \\ \eta_D \\ \eta_H \\ \eta_P \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_C^2 & & & & \\ (\rho_{WC}\sigma_C\sigma_W) & (\sigma_W^2) & & & \\ (\rho_{DC}\sigma_D\sigma_C) & (\rho_{DW}\sigma_D\sigma_W) & \sigma_D^2 & & \\ (\rho_{HC}\sigma_H\sigma_C) & (\rho_{HW}\sigma_H\sigma_W) & (\rho_{HD}\sigma_H\sigma_D) & \sigma_H^2 & \\ (\rho_{PC}\sigma_P\sigma_P) & (\rho_{PW}\sigma_P\sigma_W) & (\rho_{PD}\sigma_P\sigma_D) & (\rho_{PH}\sigma_P\sigma_H) & \sigma_P^2 \end{pmatrix} \right]$$

The model is then estimated using Full Information Maximum Likelihood (FIML) Method.

Taken together, the system of five equations is recursive as health, wealth, participation and financial dependence on children could only affect coresidence decision, but not each other. It is a correlated model as we assume that the correlations between any pair of unobservable error terms in the relevant equations could be non-zero. Thus inclusion of the source of endogeneity (i.e., non-zero cross-correlations) in the relevant equations allows us to correct for the endogeneity bias.

4. DETERMINANTS OF CORESIDENCE

The analysis is developed in stages. (a) We start with the simplest model of coresidency, where all four auxiliary variables are assumed to be exogenous.[28] These estimates are summarised in column (1) and (2) of Table 4A. While column 1 shows the estimates *without* any unobserved heterogeneity (specification 1), column (2) shows those *with* household-level unobserved heterogeneity (specification 2). (b) Estimates shown in columns (3)-(5) of Table 4A allows for the possibility that an elderly person's coresidence with children may be correlated with (i) current wealth and participation in household chores (specification 3, assuming financial dependence on children and health problems to be exogenous), (ii) financial dependence on children and current

[28] We started with pooled regressions with a gender dummy. However, since the gender dummy was significant in all equations, we included all the gender interaction terms with included explanatory variables in each equation. The final

health of the elderly person (specification 4, elderly contribution to be exogenous) and (iii) all four auxiliary variables pertaining to the contributions of both the elderly and the adult coresident children. The latter is the complete model that addresses all possible sources of simultaneity in the model. Appendix Tables A1-A4 show the corresponding estimates (jointly determined with coresidence) of financial dependence on children, elderly wealth, health and participation in various household chores equations respectively for these specifications. Finally, Table 4B summarises the estimates of the unobserved heterogeneity terms corresponding to the complete model shown in Tables 4A.

4.1. Coresidence with children

It clearly follows from Table 4B that the estimated unobserved heterogeneity terms as well as all the pairwise correlation coefficients are highly significant. We therefore argue that uncorrelated estimates (with/without unobserved heterogeneity) are likely to be biased. Hence for the rest of this paper, we shall focus on the estimates obtained from the complete model specification (5). We also compare these estimates with estimates obtained from other specifications (1)-(4) to highlight the evidence of simultaneity bias if one does not take account of the source of the bias.

Here we summarise the main results pertaining to coresidency decision. Elderly persons aged 75 or more are less likely to coreside. This is quite a robust result as it holds in all alternative specifications and therefore raises the concern as to who will care for the older elderly people, who are likely to be more frail and sick. While male elderly people are more likely to coreside, widowed and separated elderly, i.e., those without a spouse are less likely to coreside with children.

Next we consider the effect of the assistance provided by the children. First, financial

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specifications shown in Tables 4A, 4B and Appendix Tables A1-A4 are obtained by excluding the insignificant terms and thus represent the most parsimonius specifications of these equations.

assistance from children is not a significant factor influencing coresidence with children in the complete model though the variable was significant in specifications (1)-(4), highlighting the evidence of simultaneity bias in these specifications. Secondly, intensity of health problems remains insignificant in the complete model, after addressing the simultaneity bias. Note that the coefficient is however negative and significant in specifications (1), (2) and (4) while it is positive and significant in specification (3). Taken together, there is little evidence that assistance obtained from adult children is of little significance in determining an elderly person's coresidence with children.

There is however evidence that services offered by elderly parents play a more significant role in determining coresidence. In particular, there is suggestion that wealthy elderly persons are less likely while those participating in daily household chores are more likely to coreside (and the result is the same in all specifications). In this respect too, one can identify evidence of simultaneity bias. For example, the coefficient of wealth is positive and significant in specifications (1)-(3), but turns out to be negative in specification (5), when all sources of simultaneity are accounted for.

To summarise, these results suggest that uncorrected estimates of coresidence could be misleading and one needs to account for all sources of endogeneity. More importantly, these corrected estimates raise concern particularly for some disadvantaged elderly, namely, those who are older, female and do not have a spouse (who are generally considered asset poor, e.g., see Drèze and Srinivasan, 1997) and also those lacking wealth, health or both in that both these groups of elderly are less likely to coreside. Some could argue that even non-coresident elderly parents could obtain financial and other support from their children. But the available information from our data set is not very encouraging in this respect: only 20% of non-coresident elderly parents with children obtain some financial assistance from their children. Similarly, only about a third of these elderly have children living in the same village so that they could get immediate medical/personal help if needed. Thus, in the absence of any extra- familial welfare institutions,

the state needs to come forward to protect the interests of the vulnerable elderly members who lack health, wealth or both or disadvantaged in other ways.

4.2. Conditional probability estimates of coresidence

It is however noteworthy that the correlated estimates presented here do not reflect the marginal effects of the variables. Hence, we use the estimates obtained from specification 5 to calculate the probability of coresidence, conditional on the contribution of adult children, elderly parents and/or both. Denoting C, F, H, W, and P respectively for coresidence, financial dependence on children, elderly health status, wealth and participation in daily household chores, one can, for example, derive the conditional probability of coresidence conditional on different combinations of C, F, H, W and P. In particular, the conditional probability of coresidence is derived here as the ratio of joint likelihood to the corresponding marginal likelihood function using specification 5. For example, P(C=1/ F=H=W=P=1) is given as follows:

$$P(C=1/F=H=W=P=1)=\frac{P(C=F=H=W=P=1)}{P(F=H=W=P=1)}$$

Thus we split the sample into relevant groups and obtain the conditional probability estimates of coresidence for various cases, using specification 5; these estimates are shown in Table 5. These likelihood estimates clearly strengthen the role of an elderly person's current health, wealth and participation in household chores in coresidency arrangements in rural India. (a) The probability of coresidence is only 7% when an elderly has wealth and does not participate in household chores and is not dependent on the children in any other ways. (b) The probability is 78% if the elderly persons have wealth and also participates in household chores. (c) The probability however goes up to 88% if the elderly suffer from health problems, but have wealth. (d) In contrast to (c), the

probability comes down to 57% if the elderly has serious health problems, but does not have wealth and does not participate in household chores.

5. CONCLUDING COMMENTS

Little is known about the living conditions of a growing number of elderly in India most of whom tend to coreside with their children. The lack of research in this area partly reflects the general belief that these elderly are well looked after by their children. Using the recent NSS data we examine the nature of inter-generational transfers involved in coresidency arrangements among the elderly in rural India.

We argue that an elderly person's coresidence with children is a mutually advantageous arrangement where both parties tend to contribute financially and/or otherwise. The analysis commences with a comparison of the average per capita consumer expenditure (APCE) between elderly persons in different living arrangements. This suggests that the adjusted APCE figures are higher in households where elderly persons coreside with children than living otherwise. The latter highlights the contribution (financial and others) of the elderly to the households well into their old age compared to the households without elderly.

Next we examine the significance of the contributions, financial and others, made by both elderly parents and adult children on an elderly person's coresidence with children. This necessitates us to resolve the complex simultaneity problems inherent in this modelling. We adopt a unique approach to estimate the probability of coresidence, after allowing for its possible correlation with elderly person's financial dependence on children, intensity of current health problems, his/her current wealth as well as participation in daily household chores. In other words, our approach to solve the simultaneity problem has been to include the source of simultaneity (i.e., cross-correlations between these various decisions) into the coresidence

equation. These estimates tend to reveal a more complex picture than it emerges from a simple comparison of APCE across different living arrangements. While coresidency with children is a social convention in India till today and adjusted APCE is higher for elderly coresiding with children, there is indication that coresidence with children cannot by itself be regarded as sufficient means of old age insurance. In particular, these corrected results suggest that the likelihood of coresidence is lower for disadvantaged elderly persons, who are older, have no spouse and also who lack health, wealth or both in a society with no tradition of extra-familial welfare institutions.

REFERENCES

Becker, G. 1974. 'A Theory of Social Interactions', *Journal of Political Economy* 82 pp. 1063-93.

Börsch-Supan, A. 1989. 'Household Dissolution and the Choice of Alternative Living Arrangements among Elderly Americans' in the *Economics of Aging*, ed. D.A. Wise. Chicago: Chicago University Press.

Börsch-Supan, A. 1990. ' A Dynamic Analysis of Housheold Dissolution and Living Arrangement Transitions by Elderly American', in *Issues in the Economics of Aging,* ed. D.A. Wise. Chicago: Chicago University Press.

Börsch-Supan, A, D. McFadden, R Schanbel. 1996. 'Living Arrangements, Health and Wealth Effects' in D. Wise (ed.) *'Advances in Economics of Aging'*. University of Chicago Press, Chicago, pp. 193-218.

Cain, M. 1981. 'Risk and insurance: Perspectives on Ferility and Agrarian Change in India and Bangladesh', *Population and Development Review* 7 pp. 435-74.

Cain, M. 1983. 'Fertility as Adjustment to Risk', *Population and Development Review* 9 pp. 688-702.

Cameron, L. 2000. 'The Residency Decision of Elderly Indonesians: A Nested Logit Analysis', *Demography* 37(1), pp.17-27.

Cameorn, L. and D. Cobb-Clark. 2001. 'Old-Age Support in Developing Countries: Labor Supply, Intergenerational Transfers and Living Arrangements, Department of Economics, Research Paper No. 773: 37, The University of Melbourne.

Cochrane, J.H. 1999. 'A Simple Test of Consumption Insurance', *Journal of Political Economy* pp. 957-76.

Cox, D.C. and E. Jimenez. 1992. 'Social Security and Private Transfers in Developing Countries: The Case of Peru', *World Bank Economic Review* 6 pp. 155-69.

Deaton, A. and C. Paxon. 1995. 'Measuring Poverty Among the Elderly', NBER Working Paper 5296.

Da Vanzo, J. and A. Chan. 1994. 'Living Arrangements of Older Malaysians: Who Coresides with their Children?' *Demography* 31, pp. 95-113.

Drèze, J. and P.V. Srinivasan. 1997. 'Widowhood and Poverty in Rural India: Some Inferences from Household Survey Data', *Journal of Development Economics* 54, pp. 217-34.

Englehardt, G., J. Gruber and C. Perry. 2002. 'Social Security and Elderly Living Arrangements', NBER working paper #8911, April.

Gore, M.S. 1992. 'Aging of the Human Being', *The Indian Journal of Social Work*, 3(2) pp. 212-19.

Hoddinott, J. 1992. 'Rotten Kids or Manipulative Parents: Are Children Old Age Security in Western Kenya?', *Economic Development and Cultural Change* pp. 545-65.

Iacovou, M. 2000. 'The Living Arrangements of Elderly European', mimeo, Institute for Social and Eocnomic Research, Essex University.

Jellal, M. and F-C Wolff. 2002. 'Insecure Old-age Security', *Oxford Economic Papers* 54 pp. 636-48.

Kochar, A. 1999. 'Evaluating Familial Support for the Elderly: The Intrahousehold Allocation of Medical Expenditures in Rural Pakistan', *Economic Development and Cultural Change* pp. 621-56.

Kochar, A. 2000. 'Parental Benefits from Intergenerational Coresidence: Empirical Evidence from Rural Pakistan', *Journal of Political Economy* 108 pp. 1184-1209.

Kotlikoff, L.J. and J. Morris. 1987. 'How Much Care Do the Aged Receive from Their Children?' A Bimodal Picture of Contact and Assistance', NBER working paper no. 2391, Cambridge, MA: National Bureau of Economic Research.

Maddala, G.S. 1982. '*Limited Dependent and Qualitative Variables*' Cambridge University Press.

McGarry, K. and R. Schoeni. 2000. 'Social Security, Economic Growth and the Rise in Independence of Elderly Widows in the 20th Century', *Demography*, 37(2), pp. 221-36.

Mutchler, J. and J. Burr. 1991. 'A Longitudinal Analysis of Household and Non-Household Living Arrangements in Later Life', *Demography* 28(3), pp. 375-90.

Pal, S. 1994. '*Choice of Labour Contracts in Indian Agriculture: A Theoretical and Empirical Analysis'*, unpublished Ph.D dissertation, London School of Economics.

Pal, S. and R. Palacios. 2006. 'Old Age Poverty in the Indian States: What the Household Data Can Say?', mimeo Brunel University and World Bank.

Parry, J.P. 1979. *'Caste and Kinship in Kangra'*, London: Routledge and Kegan Paul.

Pollak, R.A. 1985. 'A Transaction Cost Approach to Families and Households' in Behrman, J and R. Taubman (edited) '*From Parents to Child: Intrahousehold Allocations and Intergenerational Relations in the United States'*, The University of Chicago Press, Chicago.

Rajan, S.I., U.S. Mishra and P.S. Sharma. 1999. *Indian's Elderly: Burden or Challenge*?' Sage Publications, New Delhi.

Raut, L.K. 1996. 'Old-age Security and Gender Preference Hypotheses : A Duration Analysis of Malaysian Family Life Survey Data', *Journal of Quantitative Economics* 12

pp. 81-104.

Schwartz, S. and S. Danziger and E. Smolensky. 1984. 'The Choice of Living Arrangements by the Elderly', in *Retirement and Economic Behaviour*, ed. H.J. Aaron and G. Burtless. Washington DC: Brookings Instiution.

Spitze, G., J.R. Logan and J. Robinson. 1992. 'Family Structure and Changes in Living Arrangements Among Elderly Non-married Parents', *Journal of Gerontology: Social Sciences*, 47, s289-s296.

Townsend, R. 'Risk and Insurance in Village India', *Econometrica* 62 pp. 539-91.

Vlassoff, M. and C. Vlassoff. 1980. 'Old Age Security and Utility of Children in Rural India', *Population Studies* 34(3), pp. 487-99.

Vlassoff, C. 1990. 'The Value of Sons in an Indian Village: How Widows See it', *Population Studies* 44, pp. 5-20.

Worobey, J.L. and R.J. Angel. 1990. 'Functional Capacity and Living Arrangements of Elderly Persons'. *Journal of Gerontology: Social Sciences*, 45, s95-s101 .

World Bank. 1994. '*Averting the Old age Crisis* : *Policies to Protect the Old and Promote Growth'*, Oxford University Press, USA.

Table 1A. Selected Characteristics of Elderly Living Arrangements (All members with and without children)

	Married				Widowed/separated			
	Male		Female		Male		Female	
	Spouse only	Sp. + chld	Spouse only	Sp. + chld	Alone	Child only	Alone	Child only
Ownership of financial assets	69	75	51	49	64	73	48	51
Ownership of property	83	88	56	57	77	83	62	67
Financially dependent on children	18	35	44	24	19	48	39	71
Financially dependent	20	23	53	63	18	35	40	62
Physical disability	40	33.5	31.6	29	42	44	37	42
Long-term illness	54	51	45	47	59	57	52	56
Physical immobility	11.4	7.2	6.7	6.6	7.8	10	6.5	6.8
Participates in daily household chores	86	84	88	92	92	78	93	85
Participates in social matters	83	86	77	75	81	84	71	74
Participates in religious matters	84	89	85	84	83	86	77	83
No of obs.	1098	5929	642	2758	153	1094	431	740

Note: All figures are in percentages and adjusted for sample weights.

Table 1B. Welfare Characteristics of Various Living Arrangements

	Living arrangements		
	Alone or with other relations/non-relations	With spouse only	**With children (with/without spouse)**
Owns financial assets (%)	60	61	67
Owns financial properties (%)	72	73	78
Owns financial assets & properties (%)	56	66	63
Financially dependent on children (%)	23	20	41
Provision of regular income (%)	4.3	5.2	3
Physical immobility (%)	19	10	8
Physical disability (%)	41	37	34
Chronic illness (%)	54.4	51	51
Any of these health problems (%)	67	65	62
Able to participate in daily household work (%)	90	88	84
Able to participate in social matters (%)	75	80	82
Able to participate in religious matters (%)	80	84	87
No of observations	971	1766	10952

Note: All figures are adjusted by sample weights.

Table 2: Living Arrangements and Living Standards

	Living arrangements		
Average per capita monthly consumption exp. (APCE) in Rs.	**Alone or with other relations/non-relations**	**With spouse only (without children)**	**With children (with/without spouse)**
Unadjusted APCE	370.2	372.6 (195.4)	371.9 (205.3)
Equivalence scale adjusted APCE			
1, 1, 0.6	564.2 (734.1)	516.3 (426.8)	620.1 (593.2)
1, 0.8, 0.6	610.0 (781.4)	565.5 (481.9)	672.2 (643.6)
1, 0.7, 0.5	662.9 (820.6)	620.1 (527.9)	737.9 (701.9)
Size economies of scale adjusted APCE			
0.8	497.4 (318.3)	498.8 (243.8)	521.6 (273.1)
0.6	681.8 (422.1)	679.5 (335.0)	741.8 (392.1)
0.4	951.7 (600.0)	941.1 (499.9)	1068.3 (599.4)
0.2	1350.2 (900.3)	1323.5((786.1)	1556.5 (956.6)

Note: Standard deviations are shown in the parentheses.

Table 3A. Specification of a correlated recursive model

		Contribution of the elderly		Contribution of adult children towards elderly parents	
	Coresidency	Financial : Elderly wealth	Other: Participation in various household chores	Financial	Other: elderly health problem
Intercept	√	√	√	√	√
Age>=75	√	×	√	√	√
Male	√	√	√	√	√
Widow/Separated	√	√	√	√	√
Agricultural labour	×	√	×	√	×
Other labour	×	√	×	√	×
Primary schooling	×	√	√	√	√
Higher schooling	×	√	√	√	√
Presence of educated children	×	×	×	√	×
Scheduled caste/Scheduled tribe	×	√	×	×	×
Once economically active	×	√	×	×	×
Presence of young grand children	×	×	√	×	×
Per capita expenditure (predicted)	×	×	×	×	√
Access to safe drinking water					√
Access to modern toilet facilities					√
Elderly wealth	√	×	×	×	×
Elderly participation in daily household chores	√	×	×	×	×
Health Problem	√	×	×	×	×

Financial dependence on children	√	×	×	×	×
Regional dummies	√	√	√	√	√
Family-specific unobserved heterogeneity	√	√	√	√	√

Note: Wealth: 1 if the elderly person owns property and/or financial assets. HLTHPR: 1 if the elderly person suffers from some health problem (see text). Progeny: 1 if the elderly person has any economically active son with schooling (coresident/non-coresident). Regional dummies: dummies for eastern, northern and southern states in India. In particular, NORTH1: Rajasthan, UP and MP. NORTH2: Punjab and Haryana; EAST: Bihar, Orissa, WB; SOUTH: AP, Kerala, Karnataka and Tamil Nadu.

Table 3B. Means and Standard Deviations of Selected Variables

Variable	OBS	Mean	Std Dev
Age>=75	13810	0.0800869	0.2714375
Male	13810	0.645402	0.478409
No spouse	13810	0.199204	0.399416
Primary schooling	13810	0.0907314	0. 2872371
Higher schooling	13810	0.0719044	0.2583389
Once economically active	13810	0.27357	0.445807
Presence of educated children	13810	0.5736423	0.6238092
Presence of young grand children	13810	0.8929761	1.237752
APCE/1000	13810	0.372062	0.093868
Low caste	13810	0.280956	0.449482
Elderly wealth	13810	0.773642	0.418488
Financial dependence on children	13810	0.3713251	0.4831767
Intensity of health problems	13810	0.626358	0.483788
Participation in household chores	13810	0.932223	0.2513719
	Regional dummies		
EAST	13810	0.211658	0.408499
NORTH1	13810	0.269515	0.443724
NORTH2	13810	0.073642	0.261197
SOUTH	13810	0.211079	0.408089

Table 4A. Determinants of coresidency

	No het & cor=0	With het & cor=0	With heterogeneity & non-zero correlation		
			Child's services endo.	Elderly person's services endo	Complete model
	(1)	(2)	(3)	(4)	(5)
Intercept	0.3153 ***	1.6067 ***	5.8174 ***	3.3633 ***	9.7243 ***
	-0.0495	-0.3002	-0.459	-0.6822	-0.7688
Age>=75	-0.2614 ***	-0.7069 ***	-0.6562 **	-0.8471 ***	-1.0165 ***
	-0.0432	-0.1268	-0.3009	-0.2787	-0.3671
Male	0.3073 ***	0.5821 ***	0.5725 ***	1.1658 ***	0.7449 ***
	-0.0387	-0.0841	-0.1286	-0.1439	-0.1802
No spouse	-0.3759 ***	-1.0388 ***	-2.7923 ***	-2.8949 ***	-5.5676 ***
	-0.0299	-0.0915	-0.2221	-0.2344	-0.489
Elderly financially dependent on child	0.7463 ***	2.2850 ***	0.8003 ***	4.9952 ***	0.5276
	0.0253	-0.1008	-0.2416	-0.2248	0.4216
Elderly wealth	0.1603 ***	0.3738 ***	0.4167 ***	-0.4870 **	-0.3713 **
	0.0298	0.0824	-0.1608	-0.2254	0.1732
Elderly health	-0.0807 ***	-0.2339 ***	0.1984 **	-0.2252 ***	0.0048
	0.0146	0.0371	-0.08	-0.0732	0.1123
Elderly participation in various chores	0.0678 ***	0.1483 ***	0.5855 ***	0.9844 ***	0.9525 ***
	0.0132	-0.0366	-0.0802	-0.0811	0.1343
EAST	-0.0072	0.1560 *	0.0287	0.0692	0.8392 **
	-0.0318	-0.0804	-0.2405	-0.2094	-0.3628
NORTH1	0.0049	-0.1995 ***	-0.4432 **	-0.5265 **	-0.1503
	-0.03	-0.0748	-0.2124	-0.2057	-0.3167
NORTH2	0.1913 ***	0.8349 ***	0.6470 **	0.4363	3.7402 ***
	-0.0452	-0.1246	-0.3183	-0.2978	-0.5705
SOUTH	-0.2093 ***	-0.3919 ***	-0.5870 **	-0.5561 ***	-1.1502 ***
	-0.0313	-0.0823	-0.2282	-0.2089	-0.3426
ln-L	-40669.96	-37883.1	-28178.79	-14357.89	37147.68

NOTE: Asymptotic standard errors are shown below the estimates; Significance: '*'=10%; '**'=5%; '***'=1%.

Table 4B. Structure of unobserved heterogeneity terms (complete model)

	Structure of unobserved heterogeneity terms				
	η_D (Elderly financial dependence on children)	η_W (Elderly wealth)	η_H (Elderly health problems)	η_P (Elderly participation in various chores	η_C (Elderly coresidence with children)
η_D (Elderly financial dependence on children)	2.5041 ***				
se	0.0847				
η_W (Elderly wealth)	-0.1624 ***	2.4231 ***			
se	0.0167	0.164			
η_H (Elderly health problems)	0.3051 ***	-0.1180 ***	1.9397 ***		
se	0.0199	0.0234	0.076		
η_P (Elderly participation in various chores	-0.1119 ***	0.5932 ***	-0.1894 ***	2.0403 ***	
se	0.0245	0.0214	0.0317	0.1247	
η_C (Elderly coresidence with children))	0.3884 ***	0.1060 ***	-0.0832 ***	-0.1069 ***	13.3612 ***
se	0.0223	0.0171	0.0168	0.0186	0.9828

Table 5. Conditional Probability of Coresidence with children

Case	Elderly financial dependence on children	Eldelry Health problems	Elderly wealth	Elderly participation in hh. chores	(1) Joint likelihood	(2) Marginal likelihood	Conditional likelihood (1)/(2)
1	1	0	0	0	0.002117	0.002713	0.78
2	0	1	0	0	0.0002	0.000456	0.57
3	0	0	1	0	0.01	0.1554	0.07
4	0	0	0	1	0.05465	0.088575	0.64
5	1	1	0	0	0.004322	006484	0.67
6	0	0	1	1	0.2343	0.3003	0.78
7	0	1	1	0	0.036696	0.0418	0.88

APPENDIX

Table A1 . Determinants of financial dependence on children

	Zero correlation		With het. & non-zero correlation	
	No heterogeneity	**with heterogeneity**	**Findep & health endo.**	**Complete model**
Intercept	0.1109 ***	-0.2083 **	-0.0797	-0.1599 *
	-0.0299	-0.1041	-0.0875	-0.0948
Age>=75	0.3538 ***	0.9851 ***	0.9451 ***	1.0158 ***
	-0.0402	-0.1397	-0.1268	-0.1352
Male	0.1301 ***	0.0815	0.0146	-0.0367
	-0.0329	-0.0665	-0.0657	-0.0673
Primary schooling	-0.0827 **	-0.1576	-0.1997 **	-0.2102 **
	-0.041	-0.0967	-0.0937	-0.0938
Higher schooling	-0.3561 ***	-0.5049 ***	-0.5335 ***	-0.5482 ***
	-0.046	-0.1092	-0.105	-0.1056
Agri. Labour	0.0997 ***	0.1061	0.1549 **	0.1657 **
	-0.0284	-0.0789	-0.0782	-0.0798
Other labour	0.1973 ***	0.7689 ***	0.4766 ***	0.5395 ***
	-0.0469	-0.1788	-0.1635	-0.1721
Have some girls	0.0182	-0.0514	-0.3326 ***	-0.3401 ***
	-0.025	-0.0694	-0.0644	-0.0652
Some children educated	0.0010 ***	0.0020 ***	0.0018 ***	0.0018 ***
	0	-0.0001	-0.0001	-0.0001
SC/ST	-0.0191	-0.0377	0.0252	0.0159
	-0.0229	-0.0643	-0.0628	-0.0638
EAST	0.0298	0.1495 *	0.1288	0.1590 *
	-0.03	-0.0836	-0.0815	-0.082
NORTH1	-0.2732 ***	-0.3228 ***	-0.3744 ***	-0.3186 ***
	-0.0279	-0.079	-0.0771	-0.0778
NORTH2	-0.2304 ***	-0.2303 *	-0.1624	-0.1086
	-0.0409	-0.1332	-0.126	-0.1361
SOUTH	0.0881 ***	0.2186 **	0.2725 ***	0.2823 ***
	-0.0313	-0.092	-0.0904	-0.0921

NOTE: Asymptotic standard errors are shown below the estimates;
Significance: '*'=10%; '**'=5%; '***'=1%.

Table A2. Determinants of current wealth of the elderly

	Zero correlation		Non-zero correlation	
	No heterogeneity	**With heterogeneity**	**wealth and hhwork endo.**	**Complete model**
Intercept	0.4219 ***	1.3045 ***	1.2496 ***	1.2224 ***
	-0.0308	-0.1777	-0.1406	-0.1267
Age>=75	-0.2759 ***	-0.7037 ***	-0.6362 ***	-0.5191 ***
	-0.0421	-0.0887	-0.0821	-0.0848
Male	0.8927 ***	1.9519 ***	1.8410 ***	1.9475 ***
	-0.0303	-0.0664	-0.064	-0.0704
Primary schooling	0.1487 ***	0.3059 ***	0.2845 ***	0.2803 ***
	-0.0489	-0.1031	-0.0949	-0.0977
Higher schooling	0.2293 ***	0.4215 ***	0.3999 ***	0.3329 ***
	-0.0604	-0.1411	-0.1271	-0.1249
Agri labour	-0.3734 ***	-0.8426 ***	-0.8422 ***	-0.8480 ***
	-0.0302	-0.0759	-0.0733	-0.0777
Other labour	-0.1941 ***	-0.3951 ***	-0.4591 ***	-0.4301 ***
	-0.052	-0.1264	-0.115	-0.1214
Once active	0.0005	0.0016	0.0020*	0.0022*
	0.0004	0.0014	0.0011	0.0012
SC/ST	-0.0063	-0.0828	0.0154	0.04
	-0.0263	-0.0668	-0.0614	-0.0639
EAST	0.0142	0.0582	0.0426	0.0945
	-0.037	-0.0933	-0.084	-0.0867
NORTH1	-0.0166	-0.0141	-0.0928	-0.1449 *
	-0.0337	-0.0874	-0.0784	-0.0802
NORTH2	-0.1659 ***	-0.1448	-0.2030 *	-0.1987
	-0.051	-0.133	-0.1225	-0.125
SOUTH	-0.3578 ***	-0.7529 ***	-0.7552 ***	-0.7362 ***
	-0.0353	-0.0885	-0.0818	-0.0864

Asymptotic standard errors are shown below the estimates; Significance: '*'=10%; '**'=5%; '***'=1%.

Table A3. Determinants of intensity of elderly health problems

	Zero correlation		Non-zero correlation	
	No heterogeneity	With heterogeneity	Findep & health prob. Endo	Complete model
			If has one health problem	
Intercept1	-0.6558 ***	-0.8006 ***	-0.3844 *	-0.6767 ***
	-0.1325	-0.2309	-0.1978	-0.2218
Age>=75	0.4402 ***	0.7276 ***	0.6175 ***	0.6656 ***
	-0.088	-0.1226	-0.1171	-0.1235
MALE	0.0870 *	0.3091 ***	0.2823 ***	0.3352 ***
	-0.0464	-0.0592	-0.0563	-0.059
No spouse	0.2132 ***	0.4395 ***	0.2820 ***	0.3443 ***
	-0.0518	-0.0798	-0.0724	-0.0795
Primary schooling	0.0002	-0.023	0.0465	0.0063
	-0.074	-0.109	-0.0997	-0.108
Higher schooling	-0.1853 **	-0.3797 ***	-0.2113 *	-0.3046 **
	-0.0808	-0.1265	-0.1112	-0.1231
APCE	0.0011 ***	0.0017 ***	0.0004	0.0012 **
	-0.0003	-0.0005	-0.0004	-0.0005
Safe drinking water	0.065	0.0823	0.1178	0.122
	-0.0807	-0.1377	-0.1169	-0.1315
Access to modern toilet	0.2049 ***	0.3577 ***	0.4801 ***	0.4348 ***
	-0.0536	-0.0925	-0.0818	-0.0911
EAST	0.1388 **	0.2542 **	0.0984	0.1931 *
	-0.066	-0.1138	-0.0987	-0.1113
NORTH1	-0.0663	-0.1096	-0.0909	-0.0604
	-0.0562	-0.1003	-0.0861	-0.0972
NORTH2	-0.1547 *	-0.3031 **	-0.1425	-0.2991 **
	-0.0791	-0.1461	-0.1231	-0.1394
SOUTH	0.0053	0.0524	-0.0714	-0.0127
	-0.0594	-0.1008	-0.0886	-0.0986
			If has two health problems	
Intercept2	-1.1615 ***	-1.3117 ***	-0.8993 ***	-1.1911 ***
	-0.145	-0.2366	-0.2063	-0.2289
Age>=75	1.1317 ***	1.4190 ***	1.3104 ***	1.3578 ***
	-0.0855	-0.1226	-0.1164	-0.1233
MALE	0.2188 ***	0.4393 ***	0.4139 ***	0.4661 ***
	-0.0567	-0.0693	-0.0662	-0.0691
No spouse	0.4008 ***	0.6302 ***	0.4748 ***	0.5370 ***
	-0.0573	-0.0837	-0.0766	-0.0834
Primary schooling	-0.069	-0.0937	-0.0237	-0.0633
	-0.0852	-0.1183	-0.1089	-0.117
Higher	-0.4419 ***	-0.6371 ***	-0.4687 ***	-0.5616 ***

schooling				
	-0.098	-0.139	-0.1243	-0.1354
APCE	0.0007 **	0.0013 **	0	0.0008 *
	-0.0003	-0.0005	-0.0005	-0.0005
Safe drinking water	-0.0346	-0.0158	0.0203	0.0252
	-0.088	-0.1414	-0.1227	-0.1365
Access to modern toilet	0.3003 ***	0.4504 ***	0.5714 ***	0.5258 ***
	-0.0594	-0.0953	-0.0851	-0.094
EAST	0.2902 ***	0.4093 ***	0.2530 **	0.3481 ***
	-0.0729	-0.1173	-0.1024	-0.1144
NORTH1	-0.0076	-0.0524	-0.0349	-0.0042
	-0.0647	-0.1051	-0.0912	-0.1016
NORTH2	-0.3392 ***	-0.4862 ***	-0.3283 **	-0.4823 ***
	-0.0973	-0.1556	-0.1348	-0.1497
SOUTH	0.1377 **	0.1871 *	0.0629	0.122
	-0.0679	-0.1058	-0.094	-0.1032
		If has three health problems		
Intercept3	-2.6265 ***	-2.7871 ***	-2.3770 ***	-2.6647 ***
	-0.2591	-0.3212	-0.2975	-0.3146
Age>=75	1.9992 ***	2.2869 ***	2.1772 ***	2.2256 ***
	-0.1155	-0.1459	-0.1377	-0.1461
MALE	0.2705 **	0.4901 ***	0.4640 ***	0.5146 ***
	-0.1101	-0.1179	-0.1132	-0.1177
No spouse	0.3864 ***	0.6201 ***	0.4681 ***	0.5294 ***
	-0.105	-0.1219	-0.1147	-0.1212
Primary schooling	-0.0517	-0.0774	-0.0071	-0.0464
	-0.1544	-0.1756	-0.165	-0.1743
Higher schooling	-0.3837 **	-0.5799 ***	-0.4089 **	-0.4993 **
	-0.1951	-0.2219	-0.2009	-0.2158
APCE	0.0001	0.0007	-0.0006	0.0003
	-0.0006	-0.0007	-0.0007	-0.0007
Safe water	-0.0518	-0.0356	0.0006	0.0068
	-0.1507	-0.1869	-0.1746	-0.1855
Access to mod. toilet	0.5197 ***	0.6674 ***	0.7881 ***	0.7436 ***
	-0.1032	-0.1272	-0.1198	-0.1276
EAST	-0.0278	0.0938	-0.062	0.0308
	-0.1362	-0.1656	-0.1525	-0.1626
NORTH1	-0.203	-0.2515 *	-0.2345 *	-0.2069
	-0.1238	-0.1504	-0.1389	-0.1477
NORTH2	-0.6943 ***	-0.8381 ***	-0.6858 ***	-0.8403 ***
	-0.2118	-0.2459	-0.2291	-0.2421
SOUTH	0.1709	0.2205	0.0976	0.155
	-0.1204	-0.1464	-0.1351	-0.1436

NOTE: The reference category is those without any health problems. Asymptotic standard errors are shown below the estimates; Significance: '*'=10%; '**'=5%; '***'=1%.

Table A4. Determinants of elderly person's participation in household chores

	Zero correlation		Non-zero correlation	
	No heterogeneity	With heterogeneity	Wealth and hhwork endo.	Complete model
Intercept	1.4036 ***	2.6561 ***	2.9156 ***	3.1138 ***
	-0.0426	-0.1091	-0.1507	-0.1727
Age>=75	-0.5322 ***	-0.8506 ***	-1.0224 ***	-0.9892 ***
	-0.0506	-0.0929	-0.1033	-0.113
MALE	-0.0195	-0.0617	0.0382	0.0298
	-0.0433	-0.0613	-0.0627	-0.0679
No spouse	-0.0517	-0.1552 *	-0.1663 **	-0.1233
	-0.0416	-0.081	-0.0842	-0.095
Primary schooling	0.0897	0.1507	0.1677	0.1265
	-0.0605	-0.1145	-0.1121	-0.1242
Higher schooling	0.1057	0.1854	0.2101	0.1522
	-0.0733	-0.1411	-0.1334	-0.1528
Young grand children	0.1289 ***	0.2155 ***	0.4634 ***	0.3998 ***
	-0.0319	-0.0721	-0.075	-0.0826
EAST	0.0599	0.0698	0.0275	0.0889
	-0.0451	-0.1002	-0.1038	-0.1173
NORTH1	0.3243 ***	0.5597 ***	0.4815 ***	0.4963 ***
	-0.046	-0.1166	-0.1055	-0.1178
NORTH2	0.5486 ***	1.0854 ***	1.0582 ***	1.1223 ***
	-0.0789	-0.2291	-0.2066	-0.2301
SOUTH	-0.0614	-0.1966 **	-0.2470 **	-0.1781
	-0.0448	-0.0925	-0.1014	-0.1119

Asymptotic standard errors are shown below the estimates; Significance: '*'=10%; '**'=5%; '***'=1%.